AN INVESTIGATION ON THE DIETARY CONDITIONS OF TWO RURAL COMMUNITIES IN TAIWAN PROVINCE

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Introduction

For the purpose of obtaining a preliminary information concerning the dietary status of Formosan rural communities, which is a fundamental work for the improvement of their nutrition and health, the writer has made a special investigation on the food consumption in two selected rural communities in the province. Previously, some dietary studies of Formosan inhabitants have been engaged by Prof. Hirohata (1), Prof. Sato (2), and Dr. Yo (3), either from the view of biochemistry, food chemistry or food-statistics.

Complete dietary studies would include an individual record of food consumption, full medical history and examination by competent physicians and suitable laboratory tests for mild or various nutrients, but those works are time consuming and expensive to conduct, and the interpretation of findings is often discouraging task because results are complicated by environmental and other factors which can be controlled only with difficulty. The simplest way of determining the diet of a community is to observe how much and what kind of food is consumed by the people according to their customs.

The influence of the tradition and the religion of the Formosan farmer may be the greater factors in the dietary customs. There are much more important roles than that in other countries, particularly in the cases of animal products. The diet of the Formosan farm family consists of a large degree of foods, rice, legumes, sweet potato, vegetables and domestic animal products, produced on its farm. Rice and sweet potato are principal foods ands the other subsidiary foods. Certain food stuffs to which more attenstion should be given, are prepared with the aid of fungi from leguminous seeds, either ensure that they can be preserved for a long period in the cheapest way or to

make them more digestible. These food stuffs consists of the main sources of proteins in the daily diet, in exception of the festival days and the farming seasons; only on festival days and during the farming seasons the farm family has more nourishing foods, such as meats, fishes and poultries.

It is a very interesting observation in the region that the amount of the sacrfice on festival may be proportional to the member of the altar in the family. For example, when a family has two altars, two sets of sacrifice become necessary and a piece of meat and certain quantity of fish and poultry are essential for each set of the sacrifice.

It very often happens in the region that, although the domestic pigs are usually marketed, its fat is restored for the family use. In regards to vegetable oil consumption, the family has a large legume production and the legumes are utilized for the oil supply.

On the basis of these observations or considerations the writer records the consumption of foods, rice, sweet potatoe, vegetable oils, legumes, vegetables, table salt and animal products, for a year by question and answer method when he visited the farm families of two selected communities which seem to be at a fair living level in Formosan farm.

The data will give us a clear picture as to the distribution and proportion of caloric intake, fat, protein and mineral intakes and as to some rough evaluations concerning to vitamins.

Data and Discussion

The farms considered are members of the Rural Economic Exerimental Station of Taiwan Province. One is named Sou-Chin-Liao Branch station and the other called Tai-Chung. 42 families from the former and 71 from the latter were selected for this investigation. A special attention is paid to that the family selected lives at a middle level among the farm, but its life may be situated at fair among Formosan farm. The sum of members is 501. The average member in the investigation is 7, the smallest 2 and the largest 21. Most of the families borrowed their cultivated farm from the Rural Economic Experimental Station. Only a few have their own small pieces of farm. Over majority of the inhabitants are farmers. Only a negligible member of them earns their living as a day-worker.

During the investigation the writer visited the families of two farms, then questioned as the kind and the quantity of foods they consumed in a year, from the autumn, 1947, to the summer, 1948, and their answers were recorded by the writer in July or August, 1948.

The average value of food-intake is expressed on the basis of an adult male unit by using Lusk's cofficient (4) given in the Table 3, because the error due to the difference in age distribution among population can be avoided.

In the calculation of the heat value from the nutrients the analytical data for the Formosan food products is not enough, so the writer is compelled to use the values

described in Kitayama's Table (9) and the Hand Book' (18).

In the fraction of utilization of fishes, the average analytical value between Funa (Carassius auratus) and Tunmy (Thunnus orientalis) is adopted as fresh one, and the value of Saury (Cololubis saira) as salted. Those are the common fishes eaten by the people in the regions. Nakae (4) reported that only 52% of the body of fish were actually eaten, but the writer used 50% in the computation for the sake of simplicity. In the case of poultry the author assumed 70% utilization in the computation, because no report of such estimation has ever been published. The composition of the processed soybean has been reported by Wei-Yung Lee (6) and by Sato (7), but the composition of such processed products have a very great variation. The writer, therefore, estimated their components directly from the weight of soy-bean itself. The heat value derived from unit weight of various nutrients is calculated according to Oshima's factor * (8), namely 3.9 cal./gr. for protein, 8.0 cal./gr. for fat and 4.1 cal./gr. for carbohydrate.

In the investigation of the vegetables a special attention has been paid to the mineral constituents, so that comparison was made by computing their phosphorous, calcium, iron and potassium contents. Each mineral constituent of vegetables is computed from Yo's table (3) which showed the average for the main vegetables consumed in Formosa, and the other foods are calculated from the tables of Kitayama and et al (9).

In the calculation of essential amino acid contents from protein of foods there are utilized the values reported by Block and Bolling (10) and Sato (11). In the estimation of vitamin content of foods the writer used the table prepared by Kawasaki and Ogawa (26).

* The factors were calculated on the basis of the digestible protein of Japanese foods.

(1) In. Shou-Chiu-Liao Branch Station.

The results investigated were summarized in the tables. Kleiner suggested in general way that normal men required from 3000 to 5000 cal. per day as the heat value when doing hard work (12). Food and Nutritional Board recommends 4500 cal. for the heat requirement of very active American man (13). In Buck's Land Utilization, Maynard (14) has shown that allowance is made for the smaller size and lower metabolism of the Chinese in taking 2300 calories as the minimum standard intake of energy value for an adult male. Hence it seems sufficient for requirement of the farmer investigated that the farmer daily takes 3457 cal. for an adult male unit.

The nutritive values of the average of the farmer investigated are compared with the statistical results (15), (16), (17), (18), (31), (3), published by other investigator in China or other countries. In the figures presented in Table 4, the average diet of the farmer investigated is similar to the same amount of caloric intake as compared with inhabitants in most other locations or countries, except Philippinos who have taken less protein, fat and caloric intake. But the Formosan farmer had a high consumption of carbohydrates and its amount is equal to that which found in certain locations of

China main land and other oriental countries.

The protein requirement according to John B. Youmans (19) or N. D. Heal (20) should be as high as 80 gr. to 100 gr. per day for a man having average size and average weight, and having considerable mechanical works. The Food and Nutrition Board of National Research Council (13) (in U.S.A.) also recommends that the protein requirement should be 70 g. According to Sherman (1930) the proper portion of proteins in the diet should furnish 10 to 15% of the total calories (21). Generally for the reason that plant proteins are biologically inferior to animal proteins, certain proportion, perhaps one third or more of these proteins, required be should animal origin foods.

In the farm investigated, the amount of protein taken by an adult male is 107.2 gr. per day, equal to 12.1% of the total calories. Of the amount, animal protein is 8.3 gr., corresponding to 8.6% of the total protein. Thus it is clear that protein supplied sufficient to the farmer in quantity but poor in quality. Renewed interest in the protein requirements of the essential amino acids for man was led to a redefinition of protein requierment in terms of the individual amino acids and an evaluation of diets on this basis. Block (10) has suggested allowances for the amino acids based on analyses of an average American diet and on calculations from the amino acid requirement of rats. Several objections can be made to the figures and agree in the opinion that the allowances are too high (22). Stare et al (22) have also suggested a closer approach to actual requirement from the calculations based on the amino acid composition of high quality proteins, for example, egg protein, which is highly digestible and completely utilized. When the values calculated by Block or Stare were used in comparison with the data investigated, it is evident that only lysine and leucine are slightly lower than the standards. A slight shortage of two amino acids proves an inadequate intake of proteins in quality, which means poor in animal products. According to Okada's report (15) the muscularworker in Chinese mainland takes far more protein than the Formosans (shown in the Table). In the exception of Okada's report, protein intake of the farmer is generally equal to the value obtained in the other locations or countries. For the safety of the protein nutrition of the farmer the animal protein supply should be increased twice or more, and some portion of the source of vegetable protein should be reduced. But, with the consideration of the extremely important medical finding developed and emphasized by Youman (19), —— with a high caloric diet the protein intake may be reduced safely to a very low level,—— and with the remembering the high consumption of rice and sweet potato, we see that, the probability of protein deficiency becomes very small or absent.

The daily fat supply indicates 46.7 gr. for an adult male and it occupies 11% of the total caloric intake. Comparing this value with those in other locations and countries, it is no remarked difference in an exception of that in Phillippine. Burr and Burr (23) have shown that skin lesions occured to rats when a fat deficient was given and that the sickness was cured by the addition of linolenic, linoleic or arachidonic

acid or addition of fats containing these unsaturated acids to their foods. Van Heen (24) has stated that in the most prosperous region in Java, the total fat consumption per capita per day amounts of 5 to 12 gr. per adult of 50 Kg. weight with a consumption of 2600 Cal. He is, therefore, of the opinion that one should not speak about a requirement-norm for fat, but only of a habit-norm, and that the danger of linolenic acid deficiency (should this occur in man) is very small, since fats from rice and maize and the principal non refined fats in Javanese food (coconut fat and peanut oils) contain a sufficiency of these fatty acids. Tadokoro and Saito have an experiment (25) that the diet containing higher fat has an adequate effect to rats living at higher temperature. Thus it is concluded with a certain safety that the intake is fair for the farmer.

Elvehjen has suggested that the optimal daily mineral requirment was 0.7 to 0.8 gr. for Ca, and 12-15 mg. for Fe, and Ca/P ratio is 1.0 to 1.2. (33)

The daily intake of Iron is 1.142 gr. for an adult male, which is over the standard. The intake of Ca is 0.593 gr. per day per adult male, indicating a clear shortage, and the phosphorous, 1.2359 gr. a marked surplus. It has been noted that Ca/P ratio is 0.48, far less than the standard and the possible reason is the larger consumption of rice and legumes which are too poor in Ca and rich in P.

The higher apparent consumption of table salt is given by the considerable large amount of various pickles and salted products used as the ordinary diets of the farmer. However, it may be advantageous for higher potassium consumption, whose daily intake of the farmer is 1.757 gr., but the normal requirement is 0.06 gr, for an adult male per day (26).

While the writer is fully consious of the importance of vitamin supply in the farm, no complete analytical data is available and the writer fails to make a detailed description in the terms. Only with the aid of the table published by Kawasaki (28), some rough conclusion for the nutritional state of vitamins may be drawn bellow, and the further examination would be obtained with the aid of clinical and biochemical surveys. Although it is unsafe to conclude that the vitamin A intake is a complete adequate, it appears that there is no serious deficiency in the region, because of the larger consumption of green vegetables. Of all foods in the farm diet, rice shows highest net content of vitamin B_1 than the other. But, it may be a possible damage of the vitamin during milling, and cooking. External temperature has great innfluences on the utilization of vitamin B noted by Mills (27). The vitamin B_1 supply may be exposed itself to the danger of deficiency. If enough care is taken during cooking or other processing of their foods, vitamin C may be kept in good effective state and it may be no worry about its deficiency, because the farmer has a larger consumption of vegetables. It is a interesting fact that Tang et al (32) reported a slight deficience of the vitamin (c) on the blood examination of some student of Taiwan university.

(2) Tai-Chung Branch Station

The data in the region are collected in the tables (Ⅴ, Ⅵ, Ⅶ, and Ⅷ).

General figures are similar to those in Shou-Chin Liao.

Special attention should be regarded to the higher consumption of sweet potato which leads to 820 gr. per man per day. The possible reason is that this value contains lots of sweet potato for the feeding uses. The apparent heat value, 4156 Cal. per adult per day, is over the requirement.

It is favourable that the intake of lysine is over the Block's allowance estimated as a man of 60 Kg. weight and leucine is close to the allowance, on account of the high intake of peanut. Thus it reduces the danger of protein deficiency or removes the danger.

As regards vitamin and mineral intakes, there are still unadequate state, similar to the case of Shou-Chin-Liao, except Ca. Ca intake given in the Table 8 is fair in comparison with the standard. However it should be remembered that calcium forms insoluble salts with a number of the anions (2) which occured in the intestinal canal. For example, the calcium of all vegetables actually tends to depress the absorption of Ca from other foods. This may be due to formation of oxalates, or phosphates, or to an influence of pH of the intestinal contents (2), (12), (30). Thus, the net supply of Ca will be lower than the apparent and the ratio of Ca/P may be unsafely.

Conclusion

The writer obtained the record for the preliminary information of Formosan farm.

Special attention was paid to the recording plan, which was based of the dietary life characterized with the tradition and habits of Formosan farmer. Then the record is collected by the question and answer method when the writer visited the farm families.

Shou-Chin-Liao and Tai-Chung Branch Station of Rural Econmic Experimental Station of Taiwan Province, are selected for the examination. The former situates on the southern Formosa and the latter on the middle Formosa. It may be judged from the observation that the farm family is living at fair level.

The farmers investigated have sufficient heat values from their foods as compared with the normal requirement and the values for the other oriental people.

The daily intake of protein for an adult male is more than 100 gr. The animal proteins occupy less than 10% of the total protein, inferior in its quality. In Shou-Chin-Liao, it shows a slight shortage of lysine and leucine when compared with Block's allowance. But Block's allowance is much too high in several objection and Youmans found in medical view that with a high caloric diet the protein intake may be reduced safely to very low level. Then the writer concluded the danger of protein deficiency is very small or absent.

The daily fat supply per adult, 46.7 gr. in Shou-Chin-Liao and 53.4 gr. in Tai-Cung, is an adequate state.

It is evident that Ca intakes are unsufficient, because the intakes are lower than

the standard and the values of Ca/P ratio are below than 0.5, whereas the standard requires 1.0 to 1.2 of the ratio.

Having no complete analytical results concerning to vitamins, the writer fails to draw such a clear data as the other nutrients. But a rough evaluation shows the danger of an unadequate vitamin B_1 supply and a possible fair supply of vitamin A. To vitamin C, it still remains a part to conclude.

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Table 1. Analytical Results of Foods

	Nutrient, % for foods.			Amino acid, % for food proteins									Mineral, % for foods			
	Protein	Fat	Carbohydrate	Lysine	Tryptophane	Phenylalanine	Cystine	Methionine	Threonine	Leucine	Isoleucine	Valine	Fe	Ca	P	(K)
Rice	7.72	0.77	76.79	3.2	1.3	6.3	1.3	3.4	3.9	7.7	5.1	6.4	0.001	0.009	0.069	0.070
Sweet potato	1.11	0.43	20.94	4.90	—	—	2.65	—	—	—	—	—	0.001	0.019	0.045	0.397
Lard	0.26	99.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vegetable oils	—	99.99	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Peanut	28.47	45.81	11.28	3.0	1.0	5.4	1.6	0.9	1.5	5.5	3.5	4.0	0.002	0.071	0.399	0.654
Pork	20.37	17.50	0.27													
Chick	21.33	4.55	0.75													
Duck	22.65	3.11	2.33	9.6	1.2	4.5	1.1	3.2	5.3	12.1	3.4	3.4	0.005	0.058	1.078	1.694
Goose	14.21	44.26	—													
Fish, fresh	17.53	1.16	—													
Fish, salted	28.71	6.59	—	5.7	1.2	4.8	1	3	5	10	4	4	0.0055	0.109	1.148	0.091
Soy bean	35.81	16.83	25.85	5.4	1.6	5.7	0.6	2.0	4.0	6.6	4.7	4.2	—	0.230	0.049	2.095
Vegetable	2.85	0.66	6.73	5.0	21.0	4.5	1.8	2.3	4.8	11.0	5.4	6.0	0.187	0.069	0.009	—
Fish, dried	58.70	4.28	—	5.7	1.2	4.8	1	3	5	10	4	4	0.0055	0.109	1.148	0.091

Table 2. Vitamin Contents of Foods

	A	B	C
Rice	0	1.85	0
Sweet Potato	0.1	1.2	0.3
Legumes, dried	0.0 (Trace)	5.0	0.0 (Trace)
Legumes, fresh	2.0	1.0	0.2
Pork	0.0 (Trace)	10.0	0
Poultry	0.0 (Trace)	0.5	0
Fish, fresh,	0.0	0.5	0
Fish, dried,	0.0 (Trace)	1.0	1.0
Vegetable, white leafy	1	0.5	0.5
Vegetable, green leafy	70	0.3	0.5
Vegetable, tuber,	0	0.3	0.2
Vegetable, fruity	0.5	0.3	0.1

Table 3a. Lusk's Factor for Computing the Adult-Male Units and the Computed Values in the Regions

	0 to 6 both sex,	6 to 10 both sex,	10 to 14 both sex,	14 + females	14 + males
Lusk's factor	0.50	0.70	0.33	0.83	1.0
Computed value Choun Chin Riao	24.5	34.3	43.16	78.0	107.0
Computed valus Tai-chung	32.5	38.5	60.59	126.99	134.0

Table 3b.

	Total member in the region before computation	Total value after computation	Factor for calculaiton *
Chou Chin Riao	351	286.98	1.22
Tai-Chung	500	412.63	1.21

* Factor=Total member/Total value

Table 4. Daily Intake of Protein, Fat & Calorie per an Adult Male Unit Compared to the Value Given the Other Countries & Locations.

		Protein (gr.)	Fat (gr.)	Calorie	Protein/Calorie %	Animal protein /Totalprotein %	Reference
Taiwan	Chou Chin Riao	107.2	46.1	3,457	12.1	8.6	—
	Tai-Chung	115	53.4	4.156	—	—	—
China	Average	100	—	—	12	—	14
	Wheat Region	108	—	—	14	—	
	Rice Region	91	—	—	11	—	
	(Muscle-Worker), , in Autumn	146.0	38.2	4,129.9	—	—	15
	〃 , in Winter	142.2	41.8	3.878.2	—	—	

Korea	(at a fair liveing level)	116.46	53.09	2,363.46	—	—	16
Philipine	in rural communities	63	20	2,182	—	—	17
	in towns	63	33	2,107	—	—	

Calorie Distribution

		Cereal (mainly tice)	Animal protein	Milk & dairy product	Fruits, Vegetables & legumes	Suger Candy & fats	
Phillipine		83.3%	6.6%	0.1%	7.8%	2%	33

Table 5. Average Daily Intake for a Male

	I. Chou Chin Riao	II. Tai-Chung
Rice	654.0g	612.0g
Sweet potato	42.0	820.0
Lard	18.0	7.8
Vegetable oils	1.8	8.4
Peanut	7.2	12.0
Pork	12.0	10.8
Chick	4.2	3.78
Duck	0.42	1.26
Goose	0.84	7.56
Fish, fresh	51.0	7.5
Fish, salted	2.91	1.8
Soy bean for a pickled-curd	5.04	17.48
Soy bean for soy source	14.00	10.50
Soy dean for a pickled-soy bean	3.50	6.3
Table salt	60.00	52.4
Vegetables	492.00	444.00
Fish, dried	3.78	7.2

Table 6. Daily Intake of Nutrients for a Member and an Adult Male

	for a member		for an adult	
	Chou Chin Riao	Tai-Chung	Chou Chin Riao	Tai-Chung
Protein	87.91gr.	95.15gr.	107.2gr.	115.1gr.
Fat	38.21	44.14	46.7	53.4
Carbohydrate	546.21	677.74	—	—
Calorie	2834.0	3435.0	3457.0	4156.0
Table salt	60.00	52.4	—	—

Table 7. Daily Intake of the Essential Amino Acid for an Adult Male Compared with Calculated Values for Amino-acid Requirement of Man (70kg)

	The value for the requirement		Data for an adult	
	Block	Stare	Chou Chin Riao	Tai-Chung
Lysine	5.2gr/day	1.4gr/day	4.09	4.88
Tryptophane	1.1	0.4	1.40	1.39
Phenylalanine	4.4	1.4	5.78	5.95
Cystine	3.8	0.5	1.32	1.59
Methionine		1.4	3.00	3.03
Threonine	3.5	1.2	4.12	4.25
Leucine	9.1	3.6	8.43	8.68
Isoleucine	3.3	1.3	5.21	5.06
Baline	3.8	1.3	5.82	5.84

Table 8. Daily Intake of Minerals for an Adult Male

	Chou Chin Riao.	Tai-Chung.
Fe	1142.6 Mg/day	120.6 Mg/day
Ca	593.2	769.8
(K)	1757.1	5919.2
P	1235.9	1867.4
Ca/P	0.48	0.41

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中 文 摘 要

作者記錄臺灣省農村中的食物資料，作這初步調查報告。調查設計之初，首先注意農民膳食生活上的傳統習慣。在作者訪問農場中每戶人家時，用口頭問答方式，加以記錄。地點選定臺灣省實驗經濟農場的手中寮與臺中兩分場；前者位於臺灣省南部，後者是在中部。據考察該二處的農民生活，是在一般水準以上，農民從食物中攝取的熱量，已經足够，而比之遠東若干國家的標準需要量亦多。每一成人每日攝取的蛋白質，超過100g，動物性蛋白質所佔比例低於10%，在質方面似嫌稍劣。在手中寮分場，氨基酸類中的 Lysine 與 Leucine 二種，比 Block 的標準稍爲缺乏，但有人認爲 Block氏的標準過高，而加以反對。 Youman 認爲熱量供給過剩時，可以減少蛋白質的攝取量。故作者推斷

上述二處之蛋白質缺乏的程度，微不足道，或竟可說沒有缺乏。

每一成人，每日攝取的脂肪量，手中寮是 46.7g，臺中 35.4 g，情形尚佳。

兩處食物中的鈣量，均不充分，顯然是較標準需要量爲低。兩處的鈣燐比皆在 0.5 以下，而標準量是1.0～1.2。

生活素方面，得不到詳細的分析資料，故作者不能提出一用數字的詳盡說明。但經粗略評定，已知生活素乙可能欠缺，生活素甲足够需要，至於生活素丙，則尚須進一步加以研討，目下暫缺不論。